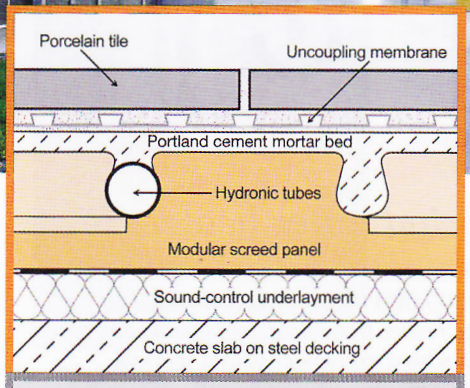
CASE STUDY

By Ronald Gagnon

RADIANT SHINES IN CORPORATE HEADQUARTERS

MECHANICALS ON THE PROJECT:

- Canadian Tunnel (passive geothermal) to precondition the fresh air. This alternates with a solar wall, as outside conditions warrant.
- Reverse-flow high-mass energy exchanger.
- Rain water harvesting system.
- Ultra low-flush toilets.
- Greywater harvesting system.
- Waterless urinals.
- Battery-less, photovoltaic-powered motion-activated faucets and flush valves.



THE COMPOSITION OF THE LOW MASS FLOOR:

A 4" concrete slab poured on a steel deck;

A soundproofing membrane;

Schluter's own Bekotec panels, which act as the piping support grids, insulation and over-pour leveling reference;

HePex piping;

A 3/4" thermal floor self-levelling over-pour;

Schluter's Ditra uncoupling membrane; and

A porcelain tile surface.

When Schluter-Systems, a German-based company that makes membranes and insulated support products used in plumbing and hydronic projects, built its Canadian headquarters in Montreal, the company decided to put its engineering prowess to the test.

The 66,000 sq. ft. LEED Gold facility uses a combination of low and high inertia zones to balance comfort and costs. A high-inertia zone is used in the warehouse and workshop area, while a low-inertia zone encompasses the office, meeting rooms, lobby and lunchroom.

The office area uses a hydronic radiant system throughout the surface of the ground floor, while the second and third floors are equipped with radiant on a 20-foot perimeter of the spaces.

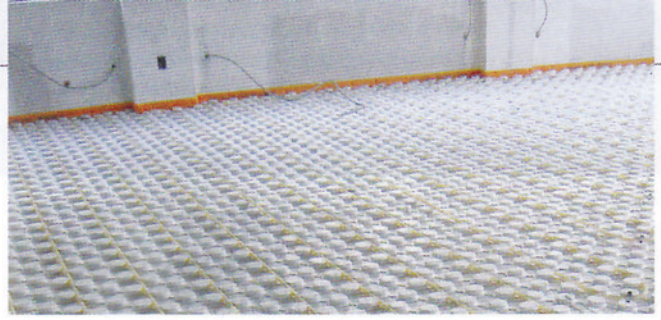
Apart from the garage section, which uses a conventional six-inch insulated slab on grade with tube spacing according to load, the rest of the office section was built with fast-response, low-inertia radiant floors. This design was used because offices are areas where thermal loads can vary rapidly and frequently due to changes in occupation density, solar gain, etc.

Installing a conventional high-mass floor in the office areas would have generated frequent cycles of overheating and overcooling caused by simple condition changes, such as clouds blocking or unblocking the sun. Going with low-mass floors allows the mechanical systems to be able to react promptly and efficiently to changing situations.

In cooling mode, the floor handles 40 per cent of the sensible load. The rest of that load, and the latent load, are handled by water-to-air heat pumps. Using this arrangement, the system is able

Did you know?

The system at Schluter has more than eleven miles of radiant tubing laid in the slabs.



to address the solar heat gain absorbed by the floor and prevent it from being retransmitted to the space by convection.

The system is not actually trying to cool the space with the floor, but rather is preventing it from warming up. That may seem to be a subtle difference, but it is fundamental to the issue of comfort. The floor never drops below room temperature, but neither is there any gain.

In heating mode the floors handle the majority of the load. The adjustment and trim capacity are taken care of by local heat pumps.

Local DDC controls maintain set points while supervising slab temperature and dew point conditions. Slabs are monitored to maintain a 2°C delta T above dew point temperature at all times. In heating mode the slabs are kept at a minimum of 20°C in unoccupied periods. This is done to avoid cold mass effect in the morning, even though the air side has a lower unoccupied set point.

By contrast to the office areas, the warehouse and workshop floors have heavy-mass, high-inertia floors. This area is served by limited glazing (window openings) so most of the natural light is supplied by skylights that have very limited contribution to the space heat gain. As such, the load does not suffer rapid changes due to solar heat gain. Occupancy is stable as the plug load, which in turn means that fast response of the floors is not a requirement.

Due to the nature of their function, these floors are 12" thick and very heavy. Their high inertia allows for stable temperature conditions, and the heavy slab is able to store energy.

In hot summer conditions, if the outside temperature rises more than 25°C by 9 a.m., the warehouse slabs are cooled down to 18°C until noon, at which point the chilled water supply is cut and the mass of the slab is left to play its role.

This strategy frees capacity to actively serve the office side. By using the slab as thermal mass storage, it is possible to downsize the cooling plant by 20 per cent. Since the building uses a geothermal cooling plant, that downsizing represented a substantial initial capital cost reduction for the building.

CUSTOMIZED *CONTROL*

Suppose during an unoccupied period, such as a Saturday morning, a member of the staff has to enter the premises. He enters the underground garage using an access card. This opens the garage door, disarms the intrusion system, lights up the garage, authorises elevator operation, lights up the path to his sector, lights up his office or work area, and re-establishes occupied set points to normal comfort settings. Upon his departure, the system will automatically reverse it all, returning the building to its unoccupied settings.

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THE PLANT

The building is served by a network of 17 water-to-air geothermal heat pumps, which range from two to five tons, as well as one water-to-water 30-ton reversible chiller.

The main advantage of a distributed network of units is the ability to address changing needs in time as units can be permuted and reassigned according to changes in use.

The other significant advantage is the elimination of the single point of failure. If a unit goes out of service the building is not crippled, and normal operation can continue.

On the energy efficiency side, having smaller units that closely fit with the natural zoning of the building supports optimized run time as no reactive loads have to be handled.

The chiller handles all the hydronic radiant floors and fan coils. The heat pumps are hooked up on a network of 450-foot deep bore wells, each with a pair of 19 mm HDPE loops (four pipes per well).